Incidence and Costs of Incidental Appendectomy as a Preventive Measure

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Abstract: Statewide hospital discharge data in South Carolina for the period 1979–81 were used to evaluate the effectiveness of the incidental appendectomy performed as a preventive measure. The occurrence of incidental appendectomy exceeded that of appendicitis treated by appendectomy, with population-based rates of 1.13/1,000 and 0.97/1,000 person-years, respectively. Over 64 per cent of appendicitis cases occurred in persons under 25 years of age while 74 per cent of incidental appendectomies occurred in persons age 25 and over. Extrapolating to the nation, the data suggest that 254,250 incidental appendectomies might prevent 3,382 future cases of hospitalized appendicitis. The cost of the prevented cases is estimated as $6,764,000. The cost of the incidental appendectomies would be $20,340,000 if as many as 10 per cent of surgeons' fees were separately charged and twice as much if twice as many were so charged. Information on charges for incidental appendectomies is not readily available. (*Am J Public Health* 1987; 77:471–475.)

Introduction

The usefulness and appropriateness of elective surgical procedures performed incidental to other surgical procedures have not been well elucidated. The primary issues involved in evaluating the validity of such practices include: their effectiveness as a preventive measure; the added risk and complication due to the incidental procedure; the cost of incidental surgical procedure in relation to the estimated savings from the diseases (or conditions) prevented at both aggregate and individual levels.

Estimates from recent years in the United States indicate that slightly under half a million (472,500) hospitalizations per year involve appendicitis and/or appendectomy.[1] This figure includes both true and false positive cases of appendicitis as well as purely incidental appendectomies (those performed during the course of another open abdominal procedure). There have been a dearth of studies dealing with the epidemiologic characteristics of appendicitis and the value of incidental appendectomy. An overview using a large patient data set with a clearly identifiable base population has rarely been examined systematically.[2–4]

An incidental appendectomy is most often performed in the course of such surgical procedures as hysterectomy, cholescystectomy, herniorraphy, cesarean section, laparotomy for trauma, and other pelvic operations.[5,6] From the individual patient point of view, the incidental appendectomy is effective as a preventive measure since it eliminates the organ at risk. However, the more logical criteria for evaluating the effectiveness of incidental surgical procedures are to assess:

- the probability of contracting the condition which the incidental procedure is intended to prevent, given the patient's present age and sex;
- the severity and mortality of the disease if contracted in the future;
- the aggregate costs vs benefits of population at large.

This study explores these issues and attempts to estimate a minimum benefit/cost ratio.

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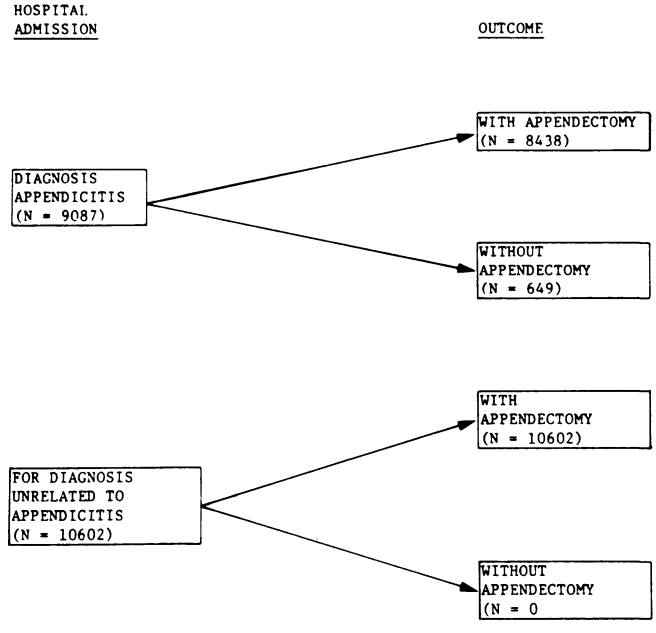

FIGURE 1—Patient Classifications

Methods

Incidence and Patient Characteristics

The computerized files of South Carolina hospital discharge data collected annually by the South Carolina Office of Cooperative Health Statistics were used for these analyses. Hospitalized cases of appendicitis (indicated by one primary and up to four secondary diagnosis codes) or appendectomy (indicated by one primary and up to four secondary procedure codes), or both, for calendar years 1979, 1980, and 1981 were identified. Military and Veterans Administration hospitals, approximately 4–6 per cent of all hospitalizations in the state, were excluded.

Hospitalizations were then classified into three categories: 1) all hospitalizations with a diagnosis of appendicitis and an appendectomy performed; 2) all hospitalizations with a diagnosis of appendicitis but no appendectomy performed; 3) and all hospitalizations with no diagnosis of appendicitis but an appendectomy performed (Figure 1). For each category; age, sex, diagnostic, and therapeutic (surgical) characteristics were recorded.

Based on these data and 1970–1980 decennial census figures, the probability of male and female future death from causes other than appendicitis, and operations associated

with incidental appendectomy for five-year age increments (except for 85–109 year old category) were calculated.

The probability of death from causes other than those related to appendicitis before the occurrence of appendicitis was also computed by sex and age. Based on these figures, the minimum number of incidental appendectomies required to prevent one case of appendicitis was computed.

Costs and Cost Savings

Based on the five-year increment-sex specific incidence characteristics, the total number of future appendicitis cases prevented by the performance of incidental appendectomies (one year period) is computed (see Appendix).

The monetary saving associated with the future cases of prevented appendicitis is computed by multiplying the total number of future appendicitis cases prevented with the current average surgeons' fee, $800, and an average hospital costs, $1,200 for primary appendectomy procedure in hospital.* This estimate of future savings is not discounted to present value in order to maximize savings side.

Estimating the costs for incidental appendectomies is a complex issue because of the multitude of factors involved. The general criteria utilized by some third party payers for the determination of separate reimbursement of incidental appendectomy (as full fledged primary appendectomy) includes body system classification of the primary procedures with which incidental appendectomy is performed, i.e., if a primary procedure is not classified as lower digestive system, it can be separately reimbursed.

There is no consensus among the third party payers about separate reimbursement for incidental appendectomy. Depending upon geographic areas, institutions, individual surgeons, and third party payers, the proportion of separately reimbursed incidental appendectomy varies widely. The billing and reimbursement practices for incidental appendectomies are unknown. However, our limited inquiries suggest that some portion of surgeons' fees for incidental appendectomies at the present time are separately reimbursed nationally.

Because of these uncertainties, we have calculated costs of 254,250 incidental appendectomies performed yearly, assuming varying percentages, 10 per cent–50 per cent, are charged fully, i.e., separately reimbursed as primary appendectomy equivalent.

Results

Incidence and Patient Characteristics

There were 19,687 hospitalizations due to appendicitis and/or appendectomy in South Carolina for the period 1979–81. This includes 8,438 hospitalizations (43 per cent) for appendicitis diagnosed and appendectomy performed; 64 per cent of these cases were under age 25; and the male to female ratio was 1.22. The subgroup, appendicitis diagnosed but without appendectomy, comprised 649 cases (3 per cent). In the category of an incidental appendectomy, there were 10,602 hospitalizations (54 per cent of the total study population); approximately 74 per cent of this group was over age 25, two-thirds being females of reproductive age, with the overall male to female ratio 0.19.

The population-based rates of incidental appendectomy for the years 1979, 1980, and 1981 were relatively stable at 1.15/1,000, 1.09/1,000, and 1.15/1,000 person years, respectively. The rates for appendicitis indicate a slightly declining trend, 1.01/1,000, 0.96/1,000, and 0.95/1,000, respectively, over the three-year period.

TABLE 1—Primary Procedures for Patients with Incidental Appendectomy

Primary Procedure	N	Per Cent
Female reproductive organs	5534	52
Digestive excludes appendix	2766	26
Appendix*	1547	15
Cesarean section	561	5
Urinary system	70	.7
Hemic lymphatic system	40	.4
All other	83	.8

*Operations on the Appendix are listed as primary procedures but performed with other procedures and no appendicitis diagnoses.

TABLE 2—Primary Diagnosis for Patients with Incidental Appendectomy

Primary Diagnosis	N	Per Cent
Other disorders of female genital tract	2823	28
Neoplasm	1814	17.8
Other diseases of digestive system	1399	13.7
Inflammatory female pelvic organs	823	8
Disease of blood 7 blood forminc	544	5.3
Normal delivery for care pregnancy labor delivery	541	5.3
Symptoms, signs, and ill defined	445	4.4
Other intestines and peritoneum	392	3.8
Noninfectious enteritis colitis	232	2.3
Ectopic molar pregnancy, pregnancy, abortion	221	2
Hernia of abdominal cavity	157	1.5
Congenital anomalies	131	1.3
Complications labor and delivery	103	1
All other	431	4.3

The primary open abdominal procedures which were accompanied by incidental appendectomies (Table 1) were predominantly female reproductive system-related. The primary diagnoses of those patients with incidental appendectomies (Table 2) were also predominantly female reproductive system-related.

The age/sex-specific incidence rates of appendicitis are shown in five-year increments in Figure 2. The age/sex-specific incidence rates for incidental appendectomies are shown in five-year increments in Figure 3.

Projecting the South Carolina data nationally, Tables 3, 4, and 5 show respectively the probability of: death from causes other than appendicitis, appendicitis, and operation leading to incidental appendectomy for each age and sex category; the probability of death from causes unrelated to appendicitis before occurrence of appendicitis (by sex and present age category); the minimum number of incidental appendectomies, by age and sex, required to prevent one case of appendicitis over future appendectomy to be beneficial. On a yearly comparison basis, the benefit of performing an estimated 254,250 incidental appendectomies per year in this country is the prevention of 89 appendicitis cases per year, 3,382 cases over 38 years of cohort life, which would have occurred in the future lifetimes of these incidental appendectomy patients.

Costs and Cost Savings

The savings associated with these 3,382 cases of prevented appendicitis amount to $6,764,000 (cost of "primary"

*Current average reimbursement figures for primary appendectomies in South Carolina are reported by the Department of Surgery, University of South Carolina School of Medicine.

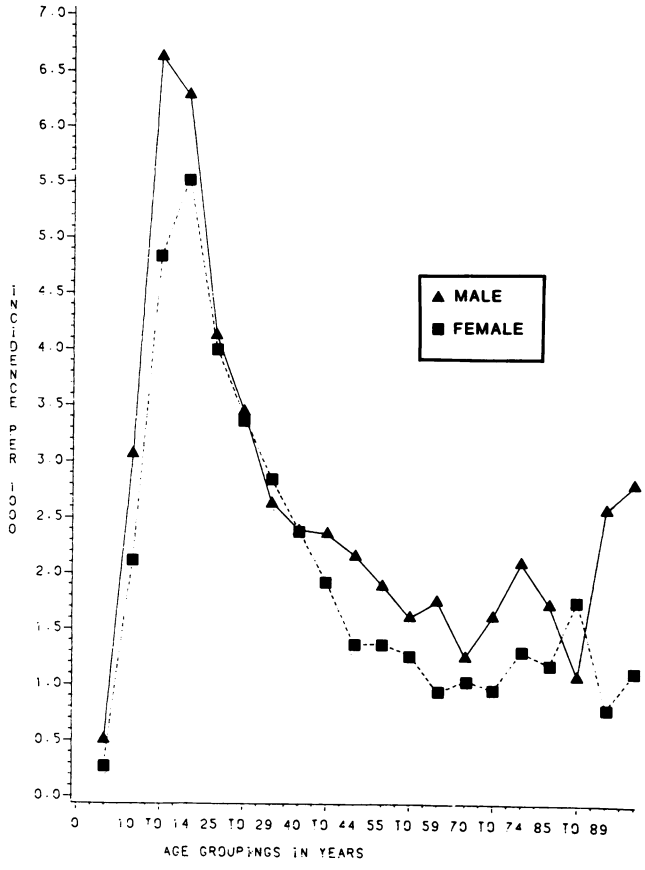

FIGURE 2—Age/Sex-Specific Incidence Rates of Appendicitis

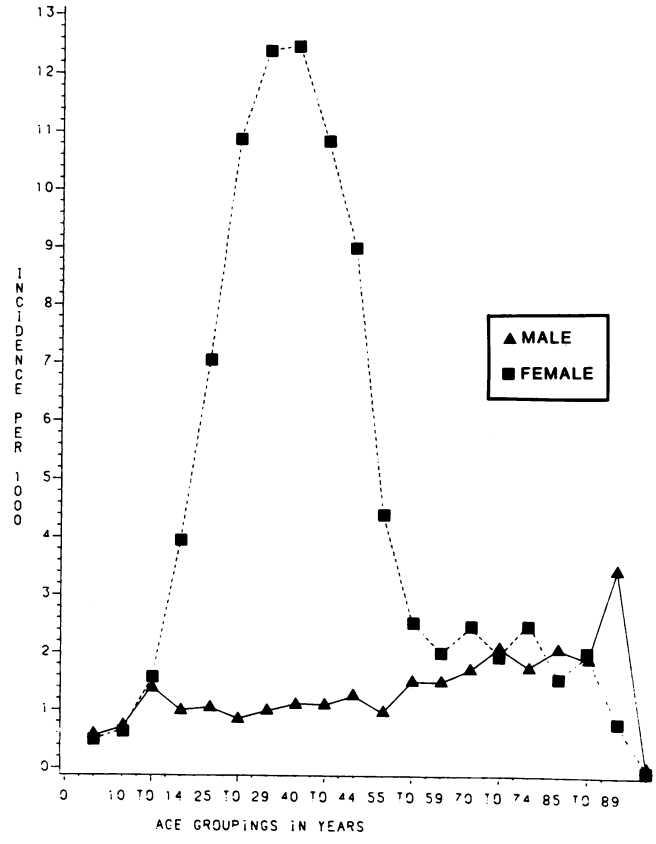

FIGURE 3—Age/Sex-Specific Incidence Rates of Incidental Appendectomy

appendectomy in hospital) spread over approximately 38 years subsequent to the year of incidental appendectomy, or $178,000 per year ($800, surgeons' fees plus $1200 average hospital costs).

On the cost side of performing 254,250 incidental appendectomies yearly, the estimate ranges from $20 million, $41 million, $61 million, $81 million, and $102 million per year, respectively assuming 10, 20, 30, 40, and 50 per cent separate reimbursement as primary appendectomy equivalent of surgeon's fee only ($800) with no added hospital charge.

Discussion

The incidence of incidental appendectomy in South Carolina (1.13/1,000) exceeds that of appendectomy for appendicitis (0.97/1,000). The frequency of incidental appendectomy has not been documented nor systematically reported in the past.

Over three-fourths of incidental appendectomies are currently performed on predominantly female patients over age 25 whose peak period for susceptibility to appendicitis has already passed and who have a markedly reduced risk for appendicitis. This raises some question as to the usefulness and propriety of the widespread performance of incidental appendectomies.

Justifications of this practice include the fact that many, perhaps most, surgeons do not charge an additional fee for performing an incidental appendectomy; the rate of postoperative complications for an incidental appendectomy is very low[7–9] and, in some studies, analyses of the products of incidental appendectomy have indicated varying proportions (8–28 per cent) of pathological findings.[7,9]

As the practice of prospective reimbursement of hospitalization expenses based on schemes such as DRGs (diagnosis-related groups) utilized by the Medicare program becomes widely adopted by other third party payers and prepaid health care organizations, the proportion of separate reimbursements may increase throughout the nation.

Whether or not separately reimbursed, the incidental appendectomy does incur costs in terms of lengthened surgical team time (estimated to average three to five minutes), operating room time, equipment utilization, and supplies expended. Also, the added post-operative care costs for an incidental appendectomy can include special dietary needs, nursing care, and possible prolongation of hospital stay.

The billing and reimbursement practices for incidental procedures including incidental appendectomy fall in a gray area. Perceptions regarding these practices varied widely, depending on whom we asked.

For example, a prominent Boston surgeon thought that the incidental appendectomy adds only $100 maximum of surgeon's fee and no increased hospital cost, while a surgeon in New York City stated that it is a common practice to bill full cost (same as primary appendectomy) of incidental appendectomy. These, of course, are anecdotes.

It is also difficult to assess these practices from third party payer sources. A primary reason for this difficulty is due to the fact that there is no classification of incidental appendectomy for reimbursement purposes. Therefore, some were not reimbursed at all, some were reimbursed at an

TABLE 3—Probability of Death from Causes Other than Appendicitis, Appendicitis, and Operations Associated with Incidental Appendectomy for Each Age Category, by Sex

Age	Death Female	Death Male	Appendicitis Female	Appendicitis Male	Incidental Appendectomy Female	Incidental Appendectomy Male
0–4	.0249	.0193	.0005	.0008	.0008	.0009
5–9	.0023	.0018	.0035	.0051	.0011	.0012
10–14	.0026	.0012	.0080	.0110	.0025	.0023
15–19	.0084	.0023	.0093	.0106	.0067	.0017
20–24	.0110	.0036	.0069	.0070	.0121	.0018
25–29	.0106	.0041	.0059	.0059	.0189	.0018
30–34	.0114	.0056	.0049	.0046	.0215	.0015
35–39	.0167	.0082	.0041	.0041	.0213	.0017
40–44	.0236	.0129	.0032	.0040	.0182	.0018
45–49	.0348	.0206	.0023	.0036	.0150	.0021
50–54	.0525	.0323	.0023	.0032	.0074	.0016
55–59	.0692	.0472	.0022	.0028	.0043	.0026
60–64	.0901	.0696	.0016	.0030	.0034	.0026
64–69	.1019	.0736	.0018	.0058	.0042	.0029
70–74	.1033	.1603	.0017	.0028	.0034	.0036
75–79	.0966	.2208	.0022	.0036	.0043	.0030
80–84	.0904	.2463	.0020	.0029	.0027	.0053
85–109	.2496*	.0703*	.0102*	.0147*	.0134*	.0177*

*This categorization was dictated primarily by our information on population sizes, which did not specify sizes in subcategories above age 85.

TABLE 4—The Probability of Death from Causes Other than Appendicitis before Occurrence of Appendicitis by Patient Sex and Present Age Category

Age (years)	Female	Male
0–4	.9443	.9285
5–9	.9454	.9304
10–14	.9507	.9379
15–19	.9588	.9481
20–24	.9664	.9566
30–34	.9776	.9680
34–39	.9818	.9722
40–44	.9852	.9760
45–49	.9876	.9796
50–54	.9894	.9826
55–59	.9910	.9850
60–64	.9921	.9870
65–69	.9927	.9907
70–74	.9932	.9941
75–79	.9938	.9958
80–84	.9944	.9965
85–109	.9973	1.0000

TABLE 5—Minimum Number of Incidental Appendectomies Required to Prevent One Case of Future Appendicitis by Age and Sex

Age (years)	Female	Male
0–4	18	14
5–9	18	14
10–14	20	16
15–19	24	19
20–24	30	23
25–29	36	27
30–34	44	31
35–39	55	36
40–44	67	42
45–49	80	49
50–54	94	57
55–59	110	66
60–64	125	77
65–69	136	106
70–74	145	167
75–79	158	233
80–84	176	279
85–109	354	>1000

increased fee for the primary procedure with which incidental appendectomy was performed, and some were reimbursed separately as a primary appendectomy. There seems to be no consensus as to which one of these three practices occupies what proportion.

The reported rate of mortality due to appendicitis and its post-operative complications in the general US population is less than one per million annually[3,9–11] and the rates of perforated appendix range from 60.3/1,000 to 210/1,000 with the mean rate of 150/1,000 appendicitis patients,[3,9–11] or about 150/million population. The mortality and morbidity associated with appendicitis are insignificant compared to the magnitude of the number of incidental appendectomies performed annually. Moreover, when considering the decision to perform incidental appendectomy *on an individual basis*, as indicated by Table 5 the cost of future appendicitis treatment has to be many times that of the current cost of incidental appendectomy and is heavily influenced by age and sex.

There are exceptions to these generalizations. Two such exceptions are the relatively rare cases of malrotation of the gut and Crohn's disease. In individuals with these conditions, incidental appendectomy should be useful.

APPENDIX

In order to estimate the number of future appendicitis cases prevented by performing incidental appendectomies, the following method was utilized. As shown in Tables 3 and 4, for example, consider a 45-year-old woman. The probability this woman will die (from causes other than appendicitis-related) before she develops appendicitis is 0.9876, thus an incidental appendectomy performed on her now will save 1 − 0.9876 = 0.0124 future appendicitis cases. In other words, about 80 incidental appendectomies performed on 45-year-old women are required to prevent one future case of appendicitis. We note in passing that this provides an alternate interpretation of Table 4 as (given age and sex) the number of incidental appendectomies required to prevent a single future case of appendicitis.

Expanding on this method, the computational procedure for the total number of appendicitis cases prevented by the estimated 254,250 incidental appendectomies performed in the U.S. per year is:

$$\sum_{\substack{\text{sex}\\ \text{grps.}}} \sum_{\substack{\text{age}\\ \text{grps.}}} \left\{ \begin{array}{l}\text{number of I.A.s}\\ \text{performed for sex}\\ \text{and age group}\end{array} \times \left[1 - \left(\begin{array}{l}\text{Table 4 value}\\ \text{for sex and}\\ \text{age group}\end{array} \right) \right] \right\}$$

= 89 (cases prevented per year)

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Meharry International Health Center Designated as WHO Collaborating Center

The Meharry Medical College International Health Sciences Center Complex received official designation as a World Health Organization Collaborating Center for Health Manpower on February 3, 1987. Both Fisk and Tennessee State Universities in Nashville will work with Meharry in realizing the goals of the center.

Designation of the center was made by Professor T.A. Lambo, deputy director of the World Health Organization, and Dr. Carlyle Guerra De Macedo, director of the Pan American Health Organization during official ceremonies on the Meharry campus.

Professor Stacey Day, director of the International Center for the Health Sciences, noted that the WHO center "will bring Meharry, Fisk and Tennessee State University a unique opportunity to advance a pioneer track in education for health and manpower development."

Meharry's International Health Center is now one of the select few WHO collaborating centers in the United States, and one of only seven in the world for health manpower development. Under the designation, the International Health Center Complex, as a collaborative effort of the three colleges, will work with WHO for training and research in community-based and community-oriented health education, and the development of strategies for improving health in community groups and institutions here and in the lesser developed countries of Africa, Asia and Latin America.

The World Health Organization is an arm of the United Nations devoted to the health of all people throughout the world. It has as its principal goal the attainment of minimum health standards for all by the year 2000, and its mission includes the sharing of health efforts among nations.

Founded in 1876, Meharry Medical College is a private, four-year historically Black institution for the education and training of health care professionals. The college has trained nearly 40 per cent of the Black physicians and dentists currently practicing in the United States. Nearly three-fourths of Meharry graduates practice in the underserved rural and inner-city communities of this nation and throughout the world.